Chapter 11: MOUNTAIN BUILDING

- MOUNTAINS
  - Beautiful, majestic, mysterious, critical.How do mountains form?
- THE APPALACHIANS
  - How did the valleys and ridges form in this distinct pattern?
- MOUNTAIN BUILDING

•Occurs via many processes

- Continental collision (Himalayas)
- Subduction zone compression (Andes)
- Rifting (East African Rift Zone)
- Volcanic mountains (Hawaii)

- CONTINENTAL COLLISION

•Continental crust ends subduction

•Collision leads to significant stress and forces on rocks

- CONTINENTAL COLLISION

• Thrust faulting occurs

•Metamorphic rocks often form

- THE HIMALAYA & TIBETAN PLATEAU
  - Massive collision of Indian sub-continent with Asia led to uplift
- SUBDUCTION ZONES

•Compression can squeeze crust together, leading to uplift

- This will cause rocks to fold and lead to thrust faults

• Exotic terranes: island fragments of continental crust that are added on to the side of the continent

- EXOTIC TERRANES
  - Dominate the western coast of North America
- RIFT ZONES

•Crust pulls apart, leading to normal faults

• Fault blocks rotate, leading to sediment basins and ridges

• Volcanic mountains form due to rising magma

- EAST AFRICAN RIFT
- STUDYING MOUNTAIN BUILDING
  - Rocks are deformed by mountain building
  - Rock outcrops yields clues about how mountains were built
- BRITTLE & DUCTILE DEFORMATION

• Brittle: Rocks break

- Occurs at low temperature & pressure
- Leads to faults & joints

•Ductile: Rocks bend

- Occurs at high temperature & pressure
- Leads to folds

- BRITTLE DEFORMATION
  - Fractures and faults cutting through a sequence of sedimentary rock strata developed after deposition of the strata
- JOINTS

•Natural crack or fracture resulting from brittle deformation

- No displacement occurs at a joint (different than a fault)
- Photo is of a shale cliff face in Ithaca, NY

➢ FAULTS
- Fractures in rock where displacement has occurred
- They are ubiquitous, and occur at all scales
- Show whether rocks were being compressed or pulled apart
- Strike-slip: no vertical motion
- Dipping or dip-slip: vertical motion

➢ FAULT ORIENTATION
- On a dipping fault, the blocks are classified as the:
  - Hanging-wall block (above the fault), and the
  - Footwall block (below the fault)
- Standing in a tunnel excavated along the fault:
  - Your head is near the hanging-wall block
  - You are standing on the footwall block

➢ TYPES OF FAULTS
- Reverse and thrust faults
  - Hanging wall is pushed up the foot wall
- Normal fault
  - Hanging wall is pulled down the foot wall

➢ NORMAL FAULT
- At a normal fault, displacement results from the crust being pulled apart (e.g. in a rift zone)

➢ REVERSE & THRUST FAULTS
- Displacement occurs from compression of the crust
- Reverse faults are steeper than 35° (close to vertical)

➢ THRUST FAULTS
- Common in places where uplift is occurring due to continental Collision
- What kind of faults are these?
- What kind of fault is this?

➢ FAULT SCARP
- Result of normal faulting after an earthquake in Nevada

➢ HORST & GRABEN
- Result of normal faulting

➢ THINGVELLIER GRABEN
- Iceland: A graben is a down-dropped block of the Earth's crust resulting from extension, or pulling, of the crust

➢ DUCTILE DEFORMATION
- Originally horizontal layers folded and distorted by tectonic Activity

➢ FOLDS
- Examples of ductile deformation

➢ ANTICLINE
- An anticline is a fold that looks like an arch

➢ SYNCLINE
- A fold that opens upward like a trough

➢ MORE FOLDS

- Folds reveal something of the process that has shaped rocks in these areas

➢ CRATONS
- A craton is crust that hasn't been deformed in 1 Ga

➢ CRATONIC

➢ PLATFORMS
- Sedimentary rock covering old (Pre-Cambrian) basementOhio Geology & The Cincinnati Arch

➢ THE APPALACHIANS
- Formed through a series of events